DUAL-POLARIZED Ku-BAND SCATTEROMETER AND POLARIMETRIC RADIOMETER MEASUREMENTS OF HURRICANE OCEAN WINDS

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There has been an increasing interest on the applicability of polarimetric microwave radiometers for wind vector (speed and direction) measurements, particularly at high winds. In addition, many studies have indicated that satellite microwave sensors such as National Aeronautics and Space Administration (NASA) Scatterometer (NSCAT) data have systematically underestimate the ocean surface wind speed in the high wind regime. To investigate these issues, we deployed a dual-polarized Ku-band scatterometer (NUSCAT) and three frequency (17, 19, and 37 GHz) polarimetric microwave radiometers (WINDRAD) on the NASA Wallops 1'-3 during the Hurricane Ocean Wind Experiment (HOWE) in September 1997.

Clear wind direction signals are observed in the NUSCAT measurements for wind speed in the range of 20 to 40 lt]s^{-1}. Both HH and VV normalized radar cross section measurements (σ_{hh} and σ_{vv}) have about 2 to 4 dB upwind and crosswind asymmetries, which are in good agreement wit h the NSCAT-1 model function. However, NSCAT-1 model function appears to overestimate the polarization ratio σ_{vv}/σ_{hh} by about 1 dB at 46" to 54°incidence angles for hurricane winds. In addition, NUSCAT data suggest that the wind speed sensitivities of σ_{hh} and σ_{vv} increase less rapidly with increasing wind speed than what is predicted by NSCAT-1 model function.

There are also clear wind direction signals in the WIN I)RAI) data. The azimuthal signatures of polarimetric radiometer data are strikingly similar to those measured at moderate wind speeds (S. H. Yueh et al., *IEEE Trans. Geoscience and Remote Sensing*, 35, 1177-1187, 1997). '1'11(! signals in T_v and T_h are often masked by clouds or precipitation. However, polarimetric U and V measurements appear to be as insensitive to clouds and rain as NUSCAT radar measurements. There are about 2-4 Kelvin peak-to-peak variations in U and V data. This amplitude is similar to that at 10-15 m·s^{-1}, suggesting the saturation of wind direction signals in passive microwave radiometer data at high winds.

In summary, our data show that scatterometers and polarimetric radiometers can perform accurate wind direction measurements at hurricane winds. Nevertheless, the saturation of wind speed sensitivit ies at high winds and the influence of clouds/rain may require a combination of both techniques to achieve accurate wind speed measurements for tropical cyclones.

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